

Precisely the same can be done for the tetanus lysin and antilysin, and the natural conclusion is that these two changes are of the same kind, a reaction taking place in each case between two molecules and resulting in the formation of two molecules of the products. It does not in any way follow that the substances concerned are of the same chemical type, and in fact other considerations render this very improbable.

In the particular experiment quoted, the amount of antilysin solution which was chemically equivalent to the lysin employed was 0.276 c.c. When this quantity of antilysin was added, however, the hæmolytic power remained equal to 36 per cent. of the original, whilst even after the addition of seven times the equivalent, the power was still 1.8 per cent. of the original. These facts, nevertheless, do not indicate the presence of a series of lysins of different hæmolytic powers and affinities for antilysin, any more than the precisely similar phenomena observed with ammonia and boric acid indicate the presence of a series of bases possessed of different hæmolytic powers and affinities for boric acid. It is therefore unnecessary to suppose, as Ehrlich has done for diphtheria toxin, that proto-, deuto- and trito-toxins as well as toxones are present.

All the phenomena are explained by the presence of a single lysin, the compound of which with its antilysin is partially decomposed into its constituents by water. Recent experiments of Dreyer and Madsen show that these conclusions may fairly be extended to the constitution of diphtheria toxin.

The deterioration of tetanus lysin is a subject of great interest in connection with the theory of toxins, and its study has also yielded interesting results, although it has not yet been pushed very far. The examination of an altered lysin by the method described above serves to indicate which of its constants—the equivalent or the coefficient of dissociation—has been altered. To take a single example, the hæmolytic power of a solution of lysin was found to have diminished to one-sixth in about five days. Examination showed that its equivalent had not altered, but that its coefficient of dissociation had increased by 50 per cent. As a result of this increase, the hæmolytic power of this lysin would be diminished to a less extent than that of the original lysin by a given dose of antilysin. The effect of deterioration in this case can therefore be explained by supposing a slight change to have occurred in all the molecules of the lysin, "perhaps a transformation into a metameric compound, less toxic," possessing an increased coefficient of dissociation and an undiminished combining power for antilysin. Ehrlich's explanation, on the other hand, would be that five-sixths of the lysin had been converted into a non-hæmolytic substance (toxoid) which had a greater affinity for the antilysin than lysin itself and was therefore "neutralised" first.

This explanation may be applicable in some cases, but, as will be seen, it is not necessarily required by the facts.

A further point of interest is that lysin and antilysin unite slowly and at a rate which can be measured. The investigation of this reaction has been carried out to a certain degree, and its further examination will probably throw more light on the nature of the change which occurs.

If the results of the authors are accepted, a great simplification of the present ideas as to the constitution of toxins will be necessary. A point which is of fundamental importance and appears to call for further examination is the mode of action of the lysin molecule in hæmolysis. In other words, does hæmolysis take place between the lysin-corpuscule and free lysin, as is the case with caustic soda, or does the lysin molecule which forms the combination bring about the hæmolysis by means of another group contained in its molecule?

A. HARDEN.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—An important change has recently been made in the regulations for Responsions. The change affects the examination in the Elements of Geometry. Instead of Euclid's Elements Books i. and ii., with Euclid's axioms and Euclid's sequence of propositions, the subject will in future be defined as the subject-matter of certain specified portions of Euclid's Elements Books i., ii., iii., and the papers will contain elementary questions on this subject-matter and easy deductions from the specified propositions. The regulations state that any

method of proof will be accepted which shows clearness and accuracy in geometrical reasoning, and that algebraical proofs of certain propositions in Book ii. will be allowed. The change is to come into force in the Michaelmas term of 1904. The announcement made by the Board of Studies for Responsions, in the *University Gazette* for November 25, reads as follows:—"In the regulations as to the Elements of Geometry (*Examination Statutes*, 1902, p. 18), the words 'Euclid's Elements, Books i., ii. Euclid's axioms will be required, and no proof of any proposition will be admitted which assumes the proof of anything not proved in preceding propositions of Euclid,' have been struck out and the following words substituted:—"Elementary questions, including propositions enunciated by Euclid and easy deductions therefrom, will be set on the subject-matter contained in the following portions of Euclid's Elements, viz., Book i., the whole, excluding propositions 7, 16, 17, 21; Book ii., the whole, excluding proposition 8; Book iii., the whole, excluding propositions 2, 4-10, 13, 23, 24, 26-29. Any method of proof will be accepted which shows clearness and accuracy in geometrical reasoning. So far as possible, candidates should aim at making the proof of any proposition complete in itself. In the case of propositions 1-7, 9, 10, of Book ii., algebraical proofs will be allowed." This change will come into force at the examination of Michaelmas term, 1904."

Sir Oliver Lodge has been appointed the Romanes lecturer for next year.

ON Wednesday evening, December 10, a paper on "French Rural Education, and its Lessons for England," will be read by Mr. Cloudesley Brereton at the Society of Arts.

THE clerk of the Privy Council has sent an official notice to the authorities at University College, Liverpool, fixing the hearing of the petition in regard to the proposed Liverpool University for Wednesday, December 17.

THE annual meeting of the Association of Technical Institutions will be held at the Goldsmiths' Hall, London, on Tuesday, January 6, 1903. The president, Lord Avebury, will occupy the chair, and an address will be given by the president-elect, Sir John Wolfe Barry, K.C.B., F.R.S.

MR. J. S. MACDONALD has been appointed to succeed Prof. Myers-Ward in the chair of physiology at Sheffield University College. Mr. Macdonald, who is at present assistant lecturer in physiology at Liverpool University College, takes up his new appointment in January next. Prof. Myers-Ward goes to Charing Cross Hospital as lecturer in physiology.

THE *British Medical Journal* announces that the Board of Trustees of Cornell University, New York, has arranged to purchase sixteen additional acres of land, and to erect new buildings, including the Hall of Physics, for which Mr. John D. Rockefeller gave a quarter of a million dollars, and a Hall of Arts and Humanities, upon which a like amount is to be expended. In connection with this University, it is of interest to notice that professors of the University who reach the age of seventy years will hereafter be retired with a pension. Their salary will be continued for one year, and they will thereafter receive 1500 dollars a year for four years, which time will doubtless be extended. They will act as special lecturers with such duties as may be assigned to them.

WE regret to see that Sir Michael Foster has written to the chairman of his Parliamentary Committee to say he feels compelled to resign his seat as member of Parliament for the University of London. He hoped to be relieved of his duties in the House of Commons at the beginning of the present term, but now, at the request of his committee, has deferred his actual resignation until the close of the present session. Among the names mentioned in connection with the vacancy thus caused are those of Sir Henry Roscoe, for some time vice-chancellor of the University, and Sir John Williams.

WRITING to the *Times*, Mr. A. C. Holzapfel points to the striking difference between English and German fees for scientific instruction. One of his sons studied chemistry at Aachen, and the fees for lectures, laboratory work, breakages, &c., were between 6*l.* and 7*l.* yearly. Another son attended King's College, London, for a course of work similar to that

his brother had had in Germany, and the fee was 47*l.* 13*s.* 9*d.* for a year. The explanation is given by the secretary of the London college, who pointed out in a letter to Mr. Holzapfel that "the continental colleges are endowed by the State, but in England they have to live on the fees of students for the most part, with a very small grant from the State in some cases and what they can raise voluntarily from the public." But it is evident that while the highest form of instruction in science can be obtained at so small a cost, there will never be a lack of properly trained men to look after the manufactures of Germany.

FULL particulars have now been published of the first annual conference of persons in the north of England concerned in primary, secondary, technical and other forms of higher education, which was announced in our issue for July 17. The conference will be divided into four sessions—two meetings on each of the days January 2 and 3, 1903—presided over respectively by Mr. M. E. Sadler, director of special inquiries to the Board of Education; Prof. H. E. Armstrong, F.R.S., Prof. Smithells, F.R.S., and Prof. L. C. Miall, F.R.S. There will be a reception by the Lord Mayor of Manchester of members of the conference on January 2, in the Municipal School of Technology, Manchester, where the meetings will be held, after which various papers will be read. Miss S. A. Burstall, head mistress of the Manchester High School for Girls, will take up the subject of the curriculum in different types of schools. Dr. Kimmins, at the afternoon meeting of the first day, deals with the coordination and delimitation of science teaching in various grades of schools. The methods of teaching experimental science in its early stages will be discussed on the morning of January 3, Mr. W. French, principal of the Storey Institute, Lancaster, taking up physics, and Mr. R. L. Taylor, of the Central School, Manchester, considering chemistry. At the last meeting, Mr. H. W. T. Wager will introduce the subject of methods of nature-study. Great care has been taken to encourage discussion at each meeting; the names of well known teachers are included in the programme as having promised to contribute to the debates. In connection with the conference, there will be an exhibition of apparatus, preparations and diagrams, such as teachers themselves have prepared or which pupils have made, to illustrate methods of nature-study and the teaching of experimental science. A class-room, fitted up as a model of what it is desired should be provided for the teaching of physics and chemistry in their early stages, will form part of the exhibition. The admission to the conference will be free, by ticket, to be obtained from the honorary secretaries, Dr. H. Lloyd Snape, Director of Education to the Lancashire County Council, and Mr. J. H. Reynolds, Director of Technical Instruction for the city of Manchester and principal of the Manchester Municipal Technical School, which is the office of the conference.

SCIENTIFIC SERIALS.

Transactions of the American Mathematical Society, vol. iii. No. 4 (October).—G. A. Miller, on the groups of order p^m which contain operators of order p^{m-2} . It appears that if $p > 2$ and $m > 5$, there are two and only two such groups not containing either an invariant cyclic subgroup of order p^{m-2} or else an abelian subgroup of type $(m-2, 1)$. These two groups are conformal respectively with the abelian groups of type $(m-2, 2)$ and of type $(m-2, 1, 1)$.—C. A. Scott, (1) on the circuits of plane curves; (2) on the real inflexions of plane curves.—J. Hadamard, on the theory of plane elastic plates.—E. J. Wilczynski, covariants of systems of differential equations, and applications to the theory of ruled surfaces. The system considered is $y'' + p_{11}y' + p_{12}z' + q_{11}y + q_{12}z = 0$ and another similar equation with z'' for y' . All covariants can be expressed in terms of three, together with invariants.—A. S. Gale, on the rank, order and class of algebraic minimum curves.—H. F. Blichfeldt, on the determination of the distance between two points in space of m dimensions. Without assuming the continuity and independence of the coordinates, but assuming that distance-relations exist, a series of axioms is laid down and possible forms deduced for the analytical expression for the distance between two points.—H. Maschke, on supersculating quadric surfaces.—E. H. Moore, a definition of abstract groups.—A. Emch, algebraic transformations of a complex variable realised by linkages.

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American Journal of Mathematics, vol. xxiv. No. 4 (October).—M. Bôcher, on systems of linear differential equations of the first order. This contains proofs of some existence-theorems by a method of successive approximation.—T. M. Putnam, on the quaternary linear homogeneous group and the ternary linear fractional group. The determinant being unity, and the group being symbolised by substitutions, the canonical forms of the generators fall into eleven principal types, with various subdivisions. The periods of the substitutions are considered, and different commutative subgroups investigated.—A. N. Whitehead, on cardinal numbers. The results of this paper are all expressed in Peano's symbolism, on which there is an introductory section.—G. A. Miller, on a method of constructing all the groups of order p^m (p being any prime).—H. F. Stecker, non-Euclidean properties of plane cubics and of their first and second polars. This is a continuation of a former paper in vol. xxii. of the same journal.

Annals of Mathematics (2) vol. iv. No. 1. (October).—G. A. Bliss, on the geodesic lines on the anchor-ring. The author obtains explicit formulæ, involving elliptic functions, which define a doubly infinite family of geodesics. He also shows that, according to Mangoldt's classification, the points on the inner equator are of the first kind and all others of the second kind. Good illustrative diagrams are given.—H. F. Blichfeldt, proof of a theorem concerning isosceles triangles.—L. E. Dickson, an elementary exposition of Frobenius's theory of group-characters and group-determinants.—E. V. Huntington, on Mr. Ransom's mechanical construction of conics.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, November 19.—Dr. J. Emerson Reynolds V.P.R.S., president, in the chair.—The "dynamic isomerism" of thiourea and ammonium thiocyanate. When the ammonium salt is heated, there is formed a definite compound of this with 25 per cent. of thiourea formed from it; further, melting-point curves of mixtures of these two substances show that other molecular combinations occur.—Isomeric partially racemic salts containing quinquivalent nitrogen; part 8, resolution of the hydrindamine camphor sulphonates, by Dr. F. S. Kipping. The author has confirmed the theory proposed by him in 1899 to account for the existence of these salts by the resolution of the partially racemic salt into four isomerides.—The oxime of mesoxamide and some allied compounds, by M. A. Whiteley. A description of the disubstituted derivatives of mesoxamide, all of which possess the characteristic properties of furnishing yellow alkali salts and purple ferrous compounds.—Interaction of ketones and aldehydes with acid chlorides, by F. H. Lees. When methyl *n*-nonylketone is acted upon by benzoyl chloride, there is formed β -benzoxyundecylene; this reaction has been extended to other ketones, and a series of benzoxyolefines so produced.—The synthesis of *aa*-dimethylglutaric acid, hydroxy-*aa*-dimethylglutaric acid, and of the *cis*- and *trans*-modifications of *aa*-dimethylglutaconic acid, by Dr. W. H. Perkin and A. E. Smith.—A reaction of some phenolic colouring matters, by A. G. Perkin and C. R. Wilson. Potassium derivatives of a number of naturally occurring colouring matters have been prepared by interaction with potassium acetate.—Note on mixtures of constant boiling point, by Dr. S. Young. The composition of the mixture of carbon tetrachloride and methyl alcohol having the minimum boiling point is shown to contain 80 per cent. of the former.—The vapour pressures and boiling points of mixed liquids, part 2, by Dr. S. Young and E. C. Fortey. Part 3, by Dr. S. Young. An investigation of the formula proposed by the authors expressing the relation between the vapour pressure of the mixture and those of its constituents. Note on the condensation points of the thorium and radium emanations, by E. Rutherford and F. Soddy. When the emanations from thorium and radium compounds are passed through a copper spiral immersed in liquid air, they are condensed and retained in the copper tube and are volatilised when the temperature is raised to -125° in the case of thorium emanation and to -130° in the case of radium.—Note on the action of barium hydroxide on dimethylviolic acid, by M. A. Whiteley. The principal product of this action is isonitrosomalondimethylamide.—The determination of strychnine and brucine in nuxvomica, by E. Dowzard. The brucine is determined by colorimetric estimation of the tint produced by the solution of the alkaloidal residue in nitric acid.